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ASTROLABES OF SAMUEL CHAMPLAIN

AND

GEOFFREY CHAUCER.

BY

HENRY SCADDING, D.D.,

AUTHOR OF "TORONTO OF OLD."

A PAPER READ BEFORE THE CANADIAN INSTITUTE, TORONTO,
DURING THE SESSION 1879-80.

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THE ASTROLABES OF SAMUEL CHAMPLAIN AND GEOFFREY CHAUCER.*

READERS of Canadian newspapers may have noticed a mention made, some time ago, of the finding of an old scientific instrument called by the French and Lower Canadian writers an Astrolabe, supposed to have been dropped by Samuel Champlain when passing up the Ottawa in 1613, *en route*, as he hoped, to the country of the Nipissings and the Salt Sea beyond. It was lighted on accidentally in 1867, during the cultivation of the soil on the line of a portage which used formerly to be traversed for the double purpose of making a short cut, and also of avoiding difficulties in the navigation in this part of the Ottawa River. The instrument, when discovered, had evidently lain long on the spot where it was found, being covered with several inches of soil formed of decayed vegetation, but its state of preservation was extraordinary. The relic itself is now in Toronto in the possession of R. S. Cassels, Esq., who obtained it directly from the settler who in 1867 ploughed it up in the rear half of lot No. 12, in the second range of the Township of Ross, in the County of Renfrew, land at the time in a state of nature, whose only previous owner had been Capt. Overman, commander of a steamer on Muskrat lake.

Previous to actually handling the object, and while judging only from a photograph taken of it and an engraving made from that photograph, I had been inclined to doubt its identity with the astrolabe said to have been lost by Champlain in this neighbourhood in 1613. The ærugo of 264 years must, I thought, have produced a greater obscurity in the lines and minute figures delineated on the surface of the brass; and a certain apparent freshness in the look of the date

*A paper read before the Canadian Institute, Toronto, during the Session 1879-80.

1603, as given in the photograph and engraving suggested a late insertion, as did also its exact coincidence with the year of Champlain's first voyage to New France. It was, without question, a genuine old astrolabe, but it might have slipped out of the baggage of any of the many parties that, since the time of Champlain, have passed and repassed along the Ottawa route on exploration, traffic, mission-work, or war, intent. A careful examination of the instrument itself, however, soon dissipated all suspicions. The brass of which it is composed is of a very close, hard texture, like bell metal: probably it is statutory brass, compounded so as to be proof against atmospheric influence. The date, 1603, stamped on the side of the disc is certainly of contemporary workmanship with the rest of the instrument. The recording of a date without the addition of a maker's name and place of abode, which at first sight likewise seemed strange, may in some degree be accounted for thus: the figures towards the circumference of the disc denoting the degrees are all not engraved, but stamped on. With punches in his hand it would be a simple thing for the maker to affix the date of the current year; while to do the same with his name and place of business, consisting perhaps of many words, would be another matter. Whether inserted by means of punches or the graving tool, the process would occupy time which the thrifty workman might think ought to be more profitably employed.

Champlain certainly had with him an instrument for taking latitudes during his expedition up the Ottawa in 1613. It can also be shown that he probably lost that instrument during the journey. Champlain kept a journal which is now to be seen in print in his 'Works' edited and published at Quebec in three volumes in 1870, by the Abbé Laverdière, of Laval University. Not having access to Laverdière's books, I avail myself of the *résumés* of this part of the journal given by Mr Russell, of Ottawa, and Mr Marshall, of Buffalo, in their respective pamphlets on 'Champlain's Astrolabe.'

Champlain records that he reached the Falls of the Chaudière on the 4th of June, 1613, the Rapides des Chats on the 5th, the island of St Croix and the Portage du Fort on the 6th. At or near Portage du Fort he turned off westward from the line of the Ottawa, and entered on what is now known as the Muskrat Lake Portage. Part of June 6th and the whole of June 7th were here passed. 'We were greatly troubled,' Champlain writes, 'in making this portage, being

myself loaded with three arquebuses, as many paddles, my cloak (capote) and some small articles (bagatelles). I encouraged my men,' he continues, 'who were loaded yet heavier, but suffered more from the mosquitoes than from their burdens.' Thus encumbered and harassed, it would be easy of course for a person to drop out of his pack a scientific instrument or other things at some point in the toilsome way without observing the loss. Very possibly this article was among the 'bagatelles' taken charge of by Champlain himself. The language of his journal implies, as we shall see, that he had with him an instrument for taking latitudes; and that it was what the French scientists of the day termed an astrolabe is likely from the fact that Champlain in an extant treatise of his on the Art of Navigation, advises all his readers to become familiar with the use of the 'astrolabe.' It is therefore pretty certain that he himself would be provided with one when on a tour of exploration.

Under date of May 30th, 1613, when at the entrance of Lake St. Louis on the Ottawa, Champlain writes in his journal—'I took the latitude of the place, and found it $45^{\circ}18''$;' and under date of June 4th, when at the Falls of the Chaudière he says: 'I took the latitude of the place, and found it to be $45^{\circ}38''$ '. And again, on the 6th of June, when at Portage du Fort, he says: 'I took the latitude of this place, which was $46^{\circ}40''$,'—words in each instance implying the use of a scientific instrument. But after the 6th of June, it is observable that his language changes. He does not again speak of 'taking' a latitude. His words become less precise, suggesting calculation perhaps by distance conceived to have been travelled. Thus, of Allumette Island or foot of the Upper Allumette Lake, he says—'It is about the 47th degree of latitude,' in which statement, it appears, he was wrong by more than a degree, the true latitude of the spot being $45^{\circ}50''$. Hence it is conjectured that his instrument for taking latitudes was now not at hand. Mr. Russell, of Ottawa, sees a further reason for supposing the absence of an instrument when at the foot of Upper Allumette Lake in the fact that Champlain was by some chance wrong in his figures at Portage du Fort, which he sets down as in lat. $46^{\circ}40''$; and this was an error committed while in possession of his instrument. For he says, '*I took* the latitude of this place.' Now Mr. Russell acutely observes, if Champlain had been in possession of his instrument at the foot of Upper Allumette Lake, and had

taken the latitude correctly there, $45^{\circ}50''$, (as the chances are, he would have done), he would have detected the mistake which he had made at Portage du Fort, and have altered his figures, for otherwise he would have absurdly proved himself to have been travelling south instead of north.

Thus then the matter stands. It appears probable, that while traversing the Muskrat Lake Portage in 1613, Champlain lost a scientific instrument called an astrolabe. In 1867, at a point in the line of this portage, such an instrument, evidently of Champlain's period, was found. We have no positive reason to adduce for disbelieving that the article found is the article that was lost. Hence, not irrationally, we allow ourselves the pleasure of thinking that we have before us, really, a veritable and most interesting relic of the bold, brave, resolute founder of Quebec and of New France.

It should be added that along with, or in close proximity to, the astrolabe, some small copper vessels or pans fitting into each other, were ploughed up, and two small silver cups with a device, perhaps a crest, engraved upon them. Although a diligent search was at once made for other articles in the locality, nothing else was found; shewing that this was not a *cache* or deposit of effects for temporary safe-keeping, but a case of accidental loss. The silver cups, of little intrinsic value, were sold sometime after the find to a passing peddler. Mr. Cassels took the trouble to trace the subsequent history of these cups, and learned that they had been melted down. As to the copper pans: when exhumed they were greatly decayed and quite useless; they accordingly became mixed up with the 'old metals' of the settler's house, and were finally lost. A portion of one of them was remembered by the finder to have been nailed over a leaky spot in a log canoe.

Also, it may be subjoined, that Parkman, in his 'Pioneers of France in the New World,' pp. 346-7, whilst giving an account of Champlain's progress on the 6th and 7th of June, 1613, makes him emerge on the expansion of the Ottawa, known as Lake Coulonge, and not at the actual spot considerably to the west, namely the mouth of Muskrat River, the natural northern terminus of the portage. Again, as we read Parkman's account of the difficulties encountered in the portage here, we can feel no surprise at the unperceived loss, under the circumstances, of such articles as those ploughed up in 1867, in the

Township of Ross. Of Champlain and his party, Parkman writes in his graphic way : 'Their march was through a pine forest. A whirlwind had swept it, and in the track of the tornado the trees lay up-torn, inverted, prostrate, and flung in disordered heaps, boughs, roots and trunks mixed in wild confusion. Over, under, and through these masses the travellers made their painful way ; then, through the pitfalls and impediments of the living forest, till a sunny transparency in the screen of young foliage gladdened their eyes with the assurance that they had reached again the banks of the open stream.' Lake Coulonge, where Parkman supposes 'the banks of the open stream' to have been again reached, was in fact an important portion of the great bend avoided by leaving the Ottawa at Portage du Fort and pushing westward to Muskrat Lake and Muskrat River, by which route a short cut to the Upper Allumette Lake was presented.

I shall now describe more minutely, the instrument which has given rise to the present discussion. It is a thick brass circular disc, about five and a half inches in diameter, finely marked off towards the outer edge into 360 degrees in the usual way, the degrees in each quadrant numbered on an inner circle from one to ninety, starting in each case from a cardinal point. For lightness, a considerable portion of the disc in each of its quarters is cut out ; or more probably the whole was originally cast in this perforated condition. A moveable bar furnished with a sight and pointer at each end, revolves on a pivot passing through the centre of the disc. A ring attached to the rim by a double hinge, enabled the observer, at his pleasure, either to suspend the instrument for observation, or himself to hold it up ; when the hinges below the ring, allowing of a certain amount of motion in two directions, would enable him to get it into a position suitable for his purpose. At the point opposite to the ring is a small projection pierced through for the reception of a screw or tack, to temporarily fasten or steady the instrument when hung up by the ring on a staff or post. Or it may have been for the suspension of a weight to ensure with greater certainty a vertical position. Discernible on the outer edge are slight remains of two other projections now broken off, at equal distances to the right and left of the lower projection. These may represent *feet*, by means of which the instrument might occasionally be supported in an upright position on a level surface. Just above the perforated projection, the date 1603 is stamped, preceded and fol-

lowed by a small cross. The year of Champlain's first visit to Canada, was 1603. On departing from Honfleur with his friend Pontgravé, in that year, he may have provided himself with this instrument, then fresh from the manufacturer's hands. The weight of the whole apparatus is about three pounds. The method of taking an observation must have been somewhat thus: allowing the instrument to hang freely, the revolving bar would be directed towards the sun at noon in such a manner that a ray might pass through both the sights to the eye; the sun's meridian altitude would thus be roughly ascertained, and the latitude of the place approximately deduced by estimation. With the circle divided only into degrees, and unprovided with any contrivance analogous to the modern Vernier, it is surprising that Champlain should have been as nearly correct as he generally is in his latitudes.

The term 'astrolabe' as indicating simply an instrument for taking altitudes seems to have continued longer in use among the French savans than among the English. No English scientific man would, I think, at the first glance, designate the object which has been engaging our attention as an astrolabe. He would call it possibly a pocket astronomical circle, a portable mural, or a rude theodolite. But in the seventeenth century, among the French, the term seems to have familiarly presented itself, and the use of it appears to have been perpetuated among the French Canadians long after the time of Champlain. For ordinary purposes, the simple instrument probably continued to be employed in Canada and France long after Vernier's improvements. Thus in 1687, seventy-four years after Champlain's first excursion up the Ottawa, we have the Baron Lahontan, when starting westward from Fort Niagara, under orders from the Governor-in-Chief, De Denonville, congratulating himself on having brought with him from Montreal, his 'astrolabe,' just as a modern officer of a scientific turn of mind, would write of his aneroid or sextant. 'Je me suis heureusement garni de mon astrolabe en partant de Montreal,' he says (*Voyages* i. 103.): 'avec lequel je pourrais prendre les hauteurs de ce lac (Frontenac or Ontario). Il ne me sera moins utile dans mon voyage, qui sera de deux ans ou environ, selon toutes les apparences.' 'Prendre le hauteur,' is also Champlain's phrase. Thus in his journal on the 4th of June, 1613, after passing the Chaudière fall, he makes an entry in his old French thus: 'Je prins le hauteur du lieu et trouvay

45 degrés, 38 minutes de latitude.' One may add, in passing, that Lahontan's astrolabe might have kept him from endorsing the extravagant notion, prevalent at that time, of the height of the falls of Niagara. To the French voyageurs, arriving in the first instance in low canoes at the base of the 'mountain' as their expression was, at what is now Lewiston or Queenston, and casting their eyes up to the then forest-crowned summit, the height to be surmounted appeared some thing stupendous. Then, after toiling with weary steps and slow, up the steep, and proceeding along the still continued, irregular slope, till at last the brink of the cataract was reached, they mentally added together the ascents of the several stages, and roughly guessed the whole perpendicular height attained since leaving the water-level at Queenston, to be something like seven or eight hundred feet. Hence the report became current that this was the height of the Falls of Niagara. With astrolabe in hand, Lahontan might have set the public right on this point. But he failed to do so.

The astrolabe employed by the primitive fathers and founders of Natural Philosophy was a more complicated instrument than that which we have thus far been contemplating. That of Hipparchus, who flourished a century and a half before the Christian era, and that of Claudius Ptolemy, author of the famous 'Almagest,' some five hundred years later, viz., A.D., 139-161, is described as consisting of a set of concentric circles, so arranged as to have one in the plane of the ecliptic, another at right angles to it; so that virtually the astrolabe of Hipparchus and Ptolemy was what used to be figured in books on Astronomy as an armillary sphere, *i.e.* a hollow sphere with all the surface cut away, except the equator, ecliptic and other circles, and furnished with a moveable tube or revolving rule, bearing sights.

In the hands of Hipparchus and Ptolemy, and numerous other sincere students of natural science, their successors in later ages, the astrolabe was put to legitimate and laudable uses: but it came at length to be a conspicuous and distinctive part of the paraphernalia of a set of impostors, who during a long period turned the ignorance and weakness of their fellow-men into a source of gain. For example: in Victor Rydberg's recent book on 'Magic in the Middle Ages,' p. 108, we have some of the objects observed in the room of a magician thus set down:—'On his writing-desk lay a parchment in which he had commenced to write down the horoscope of the following year. Be-

side the desk was a celestial globe with figures, painted in various colours. In a window looking towards the south, hung an astrolabe, to whose alidade [moveable rule], a long telescope, of course without lenses, was attached.' In Herman Merivale's 'Orlando in Roncevalles,' p. 12, we have the 'spirits of the air,' grotesquely represented as making use of material astrolabes, just as in the mediæval paintings we sometimes see angelic beings playing on violins. 'Know,' says the demon Astaroth to Malagigi,

' Know that all the circling air is dense
With spirits, each his astrolabe in hand,
Searching the hidden ways of Providence ;'

Where Merivale literally translated from his authority, Pulci ;

' Sappi che tutto quest aere è denso
Di spirti, ogn'un con astrolabio in mano.'

Since personally handling the old instrument, which, with such plausibility, can be shown to have been once the property of Samuel Champlain, the first explorer of our back lakes, and the founder, as I have said, of Quebec, I have turned with a renewed interest to a treatise on the astrolabe, which I have for some time had in my library. It is contained in Thomas Speght's second edition of the whole works of Geoffrey Chaucer, 'our ancient and learned English poet,' as he is styled on the title page. The volume is a folio, almost wholly in black letter, and its imprint is that of Adam Islip, London, 1602.

Supposing that the incident narrated as occurring in 1867, in the Township of Ross, in our Canadian County of Renfrew, may have excited amongst us some curiosity on the subject of astrolabes, I proceed to give an account of the treatise of Chaucer, just referred to.

Geoffrey Chaucer, it is to be remembered, was a many-sided man. In him, as in Burke, Canning, the first Lord Lytton, and the Disraeli of to-day, fine perceptions, a powerful imagination, and rare literary faculty did not prove incompatible with the possession of strong practical good sense, and its application in departments of life of the most serious and varied kind. He was a man of business ; a man of affairs ; a trusted and most successful diplomatist, if not a statesman ; a traveller ; a linguist ; a lover of science ; a man of wide knowledge. He wrote his treatise on the astrolabe for the use of his

son Louis, to accompany the gift made to the lad of an instrument of that name; in manuscript, of course, the printing press being a thing unknown in 1391. It is in English prose; and Speght, the editor of the folio before me, prefixes to it the following note: 'This book written to his sonne in the yeare of our Lord 1391, and in the fourteenth of k. Richard 2nd, standeth so good at this day, especially for the horizon of Oxford, as in the opinion of the learned, it cannot be amended.'

The general heading of the treatise is 'The Conclusions of the Astrolable;' this, and not 'Astrolabe' being the form of the word used by Chaucer. By 'Conclusions' he means Determinations or Problems solved by the help of the instrument.

The work is divided by Chaucer into five sections, or 'parties,' as he calls them; but only two of these seem to have survived, namely the first and second, which are to be seen in Speght. The remaining three have disappeared, or were never compiled. The first describes the form and parts of the astrolabe; the second is taken up with a discussion of the practical use of the instrument and the problems that may be worked out by it; the third and fourth exhibited, or were to exhibit, tables of latitudes, longitudes, declinations, calculations of time, movements of the moon, etc.; and the fifth spoke, or was to speak, of the theory of astrology, that is, the astronomy of the day, with tables of the 'dignities' of the planets. (Some fragments of this part have perhaps become mixed up with the matter of the second part.) In the tables and computations of the third 'party,' Chaucer says he conformed to the calendars of 'the reverend clerks, Frère John Som, and Frère N. Lenne,' Carmelite Friars, well-known conjoint authors of a treatise on the astrolabe, temp. Edward III. (In Latin forms their names appear as Nicholas de Lynue, *i. e.* of Lynn, in Norfolk, and Johannes Sombe.)

Chaucer's astrolabe was a metal disc of some thickness, certainly resembling, in a general way, that which Champlain employed, only consisting of more 'members,' as Chaucer speaks. He describes first the ring at the top 'to putten on thy thombe on thy right honde in taking the height of thynges.' This ring, he says, 'renneth in a maner of turet;' plays, that is, in a hinge-like way, so that it 'distroubleth not the instrument to hangen after his right centure,' that is to say, vertically. The disc itself, he informs his son, is called 'the moder

[mother] of thyn astrolabie.' It is thickest 'by the brinkes;' the inner portion on one side is sunk and made thin, so as to receive a light circular plate made to fit into it, with a piece of moveable open work over it, through which the plate below may be viewed. The sunken portion of the disc is called its 'wombe.' The plate just mentioned has a diagram upon it constructed for the latitude or 'clymate' of the particular place where the instrument is going to be used, hence it is made so as to be easily removed; the one furnished for Chaucer's little Louis, was 'compowned' or calculated for Oxford. The lines and circles forming the diagram on the removable 'clymate'-plate are numerous, with many intersections; and the appearance thus produced is curiously described in the following terms: 'From the signet (the apparent pole of the heaven) there comen crooked strikes (curved strokes or lines) like to the claws of aloppe (the legs of a spider), or els like to the werke of a womans calle (caul, or net for the hair), inkerving overthwart the almicanteras; and these same strikes and divisions ben cleaped azimutes, and they dividen the orizonts on thine astrolabie in 24 divi-sions. And these azimutes serve to knowe the costes of the firmament, and the other conclusions, as for to knowe the signet of the sunne and of every sterre.' The circle of open work which is to be placed over the plate of the 'clymate' is called the 'rete,' the net; as it consists of several thin strips or flattened wires, arranged somewhat after the fashion of the lines in a certain kind of fishing net, or 'else,' Chaucer says, 'after the webbe of a loppe' *i. e.* a spider's web. On each of the wires, forming the reet, which curve round or radiate from a quasi-pole, is set a mark which is to indicate the place of a certain conspicuous fixed star, and over these curving lines is placed towards the upper parts, a circular band which is 'devyded in twelve principall devisiions that deperten the twelve signs,' hence the whole 'rete' is styled 'the Zodiacke,' and it is made moveable; it may be shifted round on a centre in accordance with observations taken in the actual heavens. To admit of this movement, a 'pinne,' after the manner of an 'exiltre' [axletree], passes through the centre of the disc. This pin is ingeniously made in such a way that its diameter could be slightly lessened or increased by lifting up or pressing down a small wedge called a 'horse,' allowing the rete to revolve, but at the same time keeping the clymate-plate below firmly in its place. By loosening the wedge, the clymate-plate

could be taken out, when a change of plate was required. The pin passing through the disc was also the axis on which the radial index bearing the sights revolved on the flat or unexcavated side of the instrument. This radial index is called by Chaucer the Rule; 'it hath' he says 'on everich end,' *i. e.* each end, a square plate parted *i. e.* pierced through, with certain holes, some more and some lesse, to receyven the streems of the Sunne by day, and eke by mediation of thine eye, to know the altitude of the sterres by night.' Another name for the rule used by Chaucer is the alidatha, its appellation among the Arabs; and one may observe in passing, that probably from alidatha has been derived, by a succession of changes, the word *theodolite*. So the late Prof. de Morgan, of University College, London, held, who always spelt the word theodolete, though his practice has not been generally adopted. There are other Arabic terms in use in connection with the astrolabe; as for example, *almicanteras*, *azimuths*, *almurie*, to say nothing of the names applied to many of the stars themselves, as *alnasir*, *markab*, *algomisi*, *alhabor*,—curious reminiscences continuing to this day, of the source whence streamed the few rays of science which cheered our European forefathers during the Dark Ages. 'Astrolabe' itself is said to have passed into the European tongues through *uster-lab*, the Arabic corruption of the Greek word to which we have now more nearly reverted.

The side of the disc on which the alidatha or rule revolves is divided into a succession of concentric circles. The outermost is graduated in the usual way by quarter circles. The next is divided into twelve equal parts, each showing the name of one of the signs. The third has the names of the months arranged with relation to the signs, and giving the number of days in each month. The next has the holidays in each month marked; and the last has the letters A B C, &c., made to correspond with the names of the holidays. In the space near the centre are two scales or ladders, placed at right angles to each other, each with eleven rungs, for taking the heights of objects by means of their shadow; one scale is for taking the height by the *umbra versa*; the other by the *umbra recta* or *extensa*: these scales, the reader is told, serve for 'ful many a subtill conclusion.'

In addition to the rule, a long, thin needle or revolving index on the womb-side is spoken of, reaching to the outermost graduated circle. is is the label. Also, there is an *almurie*, a point or tooth pro-

jecting from Capricorn, serving 'of many a necessary conclusion in equacions of things.'

After describing the several parts of the instrument, Chaucer proceeds to enumerate the problems which may be solved by its use. He begins his list in these words, his grammar therein reminding one of William of Wykham's well-known 'Manners maketh man:.' 'Here beginneth,' he says, 'the conclusions of thine Astrolabie.' It will not be necessary to give an account of them all. The headings of a few of them may suffice, as : 'To know any time of the day by light of the sunne, and any time of the night by the sterres fixe, and eke to know by night or by day the degrees of the sign that ascendeth on the east horizon which is cleped commonly ascendent.' 'To know the very equation of the degrees of the sunne, if it so be that it fall between two almicanteras.' 'To know the spring of the dawning and the end of the evening, the which beene cleaped the two crepuscules.' 'To know with what degree of the Zodiake any sterre fix in thine Astrolabie ariseth upon the east orizont, although the orizont be in another signe.' 'To know the declination of any degree in the Zodiake, fro the equinoctiall cercle.' 'To know which day is like to other in length throughout the yeere.' 'To prove the latitude of any place in a region by the preffe of the height of the pole artike in that same place.' 'To know the signet for the arising of the sunne, this is to sayne, the party of the orizont in which the sunne ariseth.' 'To know sothly the longitude of the moone, or any planet that hath no latitude, from the time of the Ecliptike line.' 'To know whether any planet be direct or retrograde,' &c.

And after enumerating some thirty-eight or forty such conclusions or problems, and showing how each of them may be solved, Chaucer assures his son that these are only a portion of the conclusions that may be worked out by aid of the astrolabe, for 'trust well, he says, 'that all the conclusions that may have been founden, or possibly might be found, in so noble an instrument as is the astrolabye, ben unknown perfityly to any mortall man in this region as I suppose.' We may be sure that he had been long an adept in the use of the instrument, perhaps from the days of his youth, when at college. He narrates some of his experience with astrolabes that he had met with : he had discovered, he says, 'there be some conclusions that will not in all thyngs perfourme her behests;' 'her,' of course, is 'their,' and

he means probably that the results promised by the contriver of the instrument did not in every case come out exactly on trial. Chaucer's accurate knowledge of the astronomy of his day, and of the ingenious explanations of phenomena offered by the Ptolemaic theories, are conspicuous throughout the *Canterbury Tales*; in the *Franklin's Tale*, for example, the *Man of Law's Tale*, and the *Nun's Priest's Tale*. And I cannot but think that the well-known interior of the scholar's room at the beginning of the *Miller's Tale* is a reminiscence of his own chamber at Oxenforde in his younger days. I will transcribe the passage; in it we shall meet with the astrolabe and with the expression 'conclusions' to be technically understood in the sense already explained. 'With him,' we are told, that is with a certain lodging-house keeper at Oxford, who figures in the *Miller's Story*:

With him there was dwelling a pore scoller
Had learned art, but all his fantasye
Was tuned for to lerne astrologye,
And coude a certeyn of conclusions
To deme by interrogaciouns,
If that men axed him, in certeyn houres
When that men schuld hav drought or ellys schoures;
Or if men axed him what shulde befall
Of every thing I may nought reken hem alle.
* * * * *
A chamber had he in that hostelerie
Alone, withoughten any compaignie,
Full fetisly ydight with harbes soote [sweet],
And he himself as sweet as is the roote
Of liquorys or any cetewale [valerian]:
His almagest and bookys great and small;
His astrolabe, longing for his art [appertaining to],
His augrim stones, lying faire aparte
On schelves couched at his beddes heed,
His press y-covered with a folding red.

Chaucer probably began early to spell out the *Almagest*, the opus magnum of Claudius Ptolemy, and to make himself master of the mysteries of the augrim stones, the Arabic algorismic counters. Over and over again, he shows in his treatise on the astrolabe that he could, if he had chosen, have acted the astrologer and have cast nativities and calculated horoscopes with as great ease and plausibility as Cornelius Agrippa himself; but he draws for his son Louis a sharp line of difference between judicial and natural astrology, between astrology and astronomy, truly so called. Of the processes of the com

mon astrologer he says: 'These been observances of judiciall matter, and rites of paynims, in which my spirit hath ne faith, ne knowing of her [their] horoscopum.'

I have not yet given a specimen of the substance of Chaucer's treatise, but only the titles of some of the 'conclusions' which it records, and a description of the parts of the instrument by which they are proved. I now give one or two extracts. The want of fixity in the orthography will be noticed; no peculiarity, however, this of Chaucer's. The English language, as we know, continued to be uncertain long after his time; and the variety in the texts of early writers has been increased by the caprices and errors of the transcribers. Thus, as we shall remember, Chaucer himself rebukes one Adam Scrivener for his carelessness in copying his pieces:

' Under thy long locks may'st thou have the scall
If thou my writing copy not more true!
So oft a~day I must thy work renew,
It to correct and eke to rub and scrape;
And all is through thy negligence and rape.'

I select the first passage for the sake of the date which it contains, which takes us back at once into the fourteenth century, and places us, as it were, by the side of the scientific poet busily at work with his little son over the latter's miniature astrolabe: also for the sake of the curious comparative 'downer' for 'farther down,' which occurs at its close. (To be relished fully and judged justly, all my quotations ought properly to appear in **black letter**, as in old Speght's folio.) 'Understand well,' Chaucer says to little Louis, 'that evermore fro the arising of the sunne til he go to rest, the radius of the sunne shal shewe the houre of the plannet; and fro that time forward, all the nyght, till the sunne arise, then shall the very degree of the sunne shew the houre of the planet. Ensampl, as thus: the 13 day of March (doubtless as written at length a little while before; in the yere of oure Lorde a thousand thre hundred ninetie and one) fell upon a Saturday paraventure, and at the arising of the sunne I found the second degree of Aries sitting upon mine east orizont, all be it was but little. Then found I the second degree of Libra, nadire of my sunne, descending on my west orizont, upon which west orizont, every day generally at the sunne arising, entereth the houre of any plannet, under the foresayd west orizont; after the which planet the day

beareth his name and endeth in the next strike [stroke] of the planet, under the foresaid west orizont; and ever as the sunne climbeth upper and upper, so goeth his nadire downer and downer, eching [eking, adding on] fro suche strikes the houres of plannets by order as they sitten in heaven.'

The next passage is on account of several adverbial words rather quaintly employed therein: sadly, slyly, softly, avisely. He is showing how 'to know justly the foure quarters of the world, as East, West, South and North.' 'Take the altitude of the sunne,' he says, 'when thou liste, and note well the quarter of the worlde in which the sunne is, from the time by the azymutes; tourne then thyne astrolaby, and set the degree of the sunne in the almicanteras of his altitude on thilke syde that the sunne standeth, as is in maner of takyng of houses, and lay thy labell on the degree of the sunne, and reken how many degrees of the sunne been between the lynne meridionall and the point of thy label, and note well the nombres. Tourne then agayne thyne astrolabie and set the poynt of the great rule there thou takest thin altitudes, upon as many degrees in hys bordure from his meridionall as was the point of thy label from the line meridionall on the wombe side. Take then thyne astrolaby with both hands sadly and slyly, and let the sunne shine through both holes of thy rule, and slyly in thilke shining lay thine astrolabie couch a downe even upon a playne ground, and then will the meridionall lyne of thine astrolabie be even South, and the East line will be even East, and the West lyne West, and the North lyne North, so that thou worke softly and avisely in the couching; and thou hast thus the foure quarters of the firmament.'

The following is his clear and interesting account of a method 'to prove the latitude of any place in a region by the preffe of the height of the pole artike in that same place':—

'In some winters night,' he says, 'when the firmament is cleere and thicke sterred: wayt a time till that any ster fix sit line right perpendicular over the pole artike, and clepe that ster A; and wayte another sterre that sit lyne right under A, and under the pole, and clepe that sterre F; and understand well that F is not considered but onely to declare that A that sit ever on the pole. Take then anone right the altitude of A from the orizonte and forgette it not. Let A and F go farewel till agaynst the dawning a great while, and come

then again, and abide till that A is even under the pole under F, for sothely then will F sit over the pole. Take then eftsones the altitude of A from the orizonte, and note as well the seconde as the first altitude. And when that this is done, reken how many degrees that the first altitude A exceeded his altitude, and take halfe the ilk porcion that is exceeded, and add it to his second altitude, and take there the elevacion of the pole and eke the altitude of thy region. For these two ben of one nombre, that is to saine, as many degrees as thy pole is elevat, so moch is the latitude of thy region. Ensampl as thus : Paraventure the altitude of A in the evening is 82 degrees of hyght, then will the second altitude or the dawning be 21 ; that is to saine, less by 61 than was his first altitude at even. Take then the half of 61, and adde to it 21, that was his second altitude, and then thou hast the height of the pole and the latitude of thy region. But understand well,' he adds, 'to preve this conclusion, and many another fayre conclusion, thou mayest have a plomet hangyng on a lyne higher than thy head on a perche, and that lyne mote hang even perpendiculer bitwixt the pole and thine eye, and shalt thou see if A sit seven over the pole and over F at even. And also if F sit even over the pole and over A at day.'

My last specimen shall be the 'conclusion,' entitled 'Special declaration of the Ascendent,' in which Chaucer takes occasion to speak of a subtle process by which certain portions of the heavenly bodies, astrologically bad, are sometimes, nevertheless, interpreted as good. 'The Ascendent,' he says, 'soothly is as well in all nativities as in questions, and as in elections of times, is a thing which that the astrologians greatly observen ; wherefore meseemeth convenient, sens I speake of the ascendent, to mak of it a special declaration. The ascendent soothly, to take it at the largest, is thilke degree that ascendeth at anye of these foresayd times on the East orizont ; and therefore, if that any planet ascend at thilke same time in the foresaid same gree of his longitude, men say that thilke plannet is in *Horoscopo* ; but thly, the house of that ascendent, that is to say, the first house or the sooeast angle, is a thing more broad and large ; for, after the statute of astrologiens, what celestial body that is five degrees above thilke degree that ascendeth on the orizont, or within that number, that is to say, nere the degree that ascendeth, yet reken they thilke planet in the ascendent ; and what planet is under thilke degree that ascendeth the

space of 25 degrees, yet saien they, that planet is like to him, that is [in] the house of the ascendent ; but soothly, if he pass the bounds of the foresaid spaces, above or beneath, they sayne that thilke planet is falling fro the ascendent ; yet sayne these astrologians, that the ascendent may be shapen for to be fortunate or infortunate, as thus : A fortunate ascendent cleapen they, when that no wicked planet of Saturne or Mars or els the taile of the Dragon is in the house of the ascendent, ne that no wicked planet have no aspect of enmitie upon the ascendent ; but they woll cast that they have fortunate planet in her (their) ascendent, and yet in his felicitie, and they say that it is well. Further more, they sayne that Fortune of an Ascendent is the contrary of these foresaid thyngs.* The Lord of the ascendent, sayne they, that he is fortunate when he is in good place for the ascendent, and eke the Lord of the Ascendent is in an angle or in a succedent, where he is in his dignitie and comforted with friendle aspectes receyved, and eke that he may seene the Ascendent not retrograde, ne combust, ne joyned with no shrewe in the same signe, ne that he be not in his discention, ne reigned with no planet in his discentions, ne have upon him none aspect infortunate ; and then they sayne that he is well.' Then follows the declaration already quoted : ' Nathelesse these ben observances of judiciale matter and rites of paynims, in which my spirit hath no faith ne knowing of ther horoscopum : for they sayn,' he adds, ' that every signe is departed in three even partes by ten degrees, and the ilk portion they clepen a Face ; and although a planet have a latitude fro the Ecliptike yet saien some folk so that the planet arise in that same signe with any degree of the foresaid face in which is longitude, is rekened, yet is that planet in horoscopo, be it in nativities or in election.' This exposition of details on the part of the astrologians was, no doubt, clear enough to Chaucer ; but he did not care that his son, or any other future reader, should be further initiated in a pseudo-science.

It remains now to say a few words of the little Louis, to whom the ' Treatise on the Astrolabe ' was addressed. It appears that he was at the time only ten years of age. The subject discussed may seem to us one above the capacities of a lad of such tender years. But Chaucer understood the boy. He saw that he had inherited a mathematical head ; that he was developing tastes similar to his own. Often, doubtless, had the child stood by while the father was experimenting with

an astrolabe, and without any effort he had become precociously familiar with the instrument and its mysteries, just as a clever child now quickly masters chess or elementary chemistry. Should we not have liked to overhear the quiet confidential interchange of talk between the two, while the instrument was being manipulated? We would have been interested in the English; so homely occasionally; so provincial perhaps sometimes, we would think in pronunciation, and tone and style!

The application for further instruction in the astrolabe, in its theory and practical use, came, we are informed, from Louis; and the father was only too glad to gratify him. So he provided him with an astrolabe, not one of full size, as it would seem, but still not a toy; and in addition he furnished him with the tractate which we have been examining. It would be simply amusement to Louis to carry forward to any extent the studies suggested; and philosophy in sport would be sure to become science in earnest with him by and by, if his life should be spared; and Chaucer was quite willing that his son should be grounded in the best knowledge that could be had; in the true science of nature, so far as it had then been attained.

The natural affection of the father breaks out in several places in the treatise. It is observable in the first sentence of the book, 'Little Louis, my sonne,' he says, 'I perceive well by certain evidences, thine ability to learn sciences, touching numbers and proportions; and also well consider I thy busy prayer in especial to learn the treatise of the astrolabye. Then,' he continues, 'for as much as a philosopher saith; hee wrappeth him in his friend that condescendeth to the rightfull prayers of his friend, therefore I have given thee a sufficient astrolabe for our orizont, compowned after the latitude of Oxenforde; upon the which, by the mediation of the little treatise I purpose to teach thee a certain number of conclusions pertayning to this same instrument.' Again, further on, where he defines which is the right side and which is the left of the astrolabe: 'The east side of the astrolabe is cleaped the right side, and the west side is cleaped the left side; forget not this little Louis.' And similarly, the name of the lad addressed, suddenly appears in other places.

Chaucer adopts an apologetic tone for having ventured to deliver the treatise on the astrolabe to his son in the English tongue. He stood in some awe perhaps of certain members of the teaching order,

old friends at Oxford in years by gone, it may be. Or possibly it was the family tutor, who would think that things were being made altogether too easy for little Louis; how would his growing faculties be disciplined, it might be asked, if learning was to be deprived of its asperities; if propositions were to be enunciated, and demonstrations given, all in plain English? 'Latine, ne canst thou nat yet but smale my little Louis,' he idiomatically says, piling his negatives one upon the other, therefore, 'I will shewe,' he says, 'the wonder light rules and naked words [explanatory of the astrolabe] in English.' Sufficiently abstruse as the 'conclusions,' on the whole may seem to be, Chaucer considered he was supplying milk to babes, in comparison of the strong meat that might be dispensed on the subject in hand. The book ought of course to be made harder, he seems to say, by translation into Latin; he hopes, however, the boy will have the good sense not to despise it on account of its familiar guise; but he does not see why English folk should not make use of their vernacular in matters of learning, just as ancient nations had done with their respective vernaculars. The old nations did not each translate the truths of science into a foreign tongue, and then master them, but they mastered them out of books in their own tongue. Therefore, he says to Louis: 'Sufficeth to thee these true conclusions in English, as well as sufficeth to the noble clerks, the Greekes, these same conclusions in Greek; and to the Arabines, in Arabike; and to Jews, in Hebrew; and to the Latin folke in Latine which Latin folk themselves', he adds, 'had hem first out of other divers languages, and writ hem in her [their] own tongue, that is to sayne in Latine.' Soon after this he brings to a close his address to the boy on this subject, merrily and loyally, thus: 'Louis,' he says, 'if so be that I shew thee in my lith [scant] English, as true conclusions touching this matter, and not only as true, but as many and subtill conclusions, as ben yshewed in Latine, in any common treatise of the astrolabie, conne me the more thanke; and may God save the king, who is lord of this lngauage, and all that him faith beareth and obeyeth, everiche [one] in his degree, the more and the lasse.' In thus breaking away from the mediæval routine in the instruction of the young, Chaucer shews himself a worthy forerunner of Roger Ascham and Milton, of Locke, Gibbon, and the modern school generally of enlightened educationists.

We know nothing of the subsequent history of little Louis. The

career of an elder brother Thomas, is noted in some of the biographies of the poet ; but the boy Louis passes off the stage without giving any further sign. He is seen only, but very clearly, in the 'Treatise on the Astrolabe.' Like one of the tiny ephemera of ages long ago occasionally seen in amber, there he remains embalmed. Perhaps we have a reminiscence of him in the story told by the Prioress, on the way to Canterbury, about the 'little clergion, seven years of age,' martyred by the Jews in a 'great city in Asia,' for singing *Alma Redemptoris Mater*, as he passed through their ghetto.

'This litel child his litel boke lerning,
 As he sat in the scole at his prymer,
 He *Alma Redemptoris* herde singe
 As childern lerned hir [their] antiphoner,
 And as he dorste, he drough hym ner and ner
 And herkned ay the wordes and the note,
 Till he the first vers coudē al by rote
 Nought wistē what this Latin was to sey,
 For he so young and tendre was of age ;
 But on a day his felaw gan he preye
 T'expounden him this song in his langage
 Or telle him why this song was in usage.'

This sounds very like an incident in the childhood of the little lad, who at ten years of age desired to be told all about the astrolabe.

It is to be hoped that over stimulation of the brain by a too great absorption in matters fitted for riper minds, did not prove the cause of premature decay in little Louis. Here of course is a danger which will attend the case of a precociously clever child in every age.

We are all familiar with the figure of Geoffrey Chaucer himself, from the full length effigy of him supplied by Thomas Occleve, and given in Speght, and often prefixed as a frontispiece to his works. As with Shakespeare, Dante, Caxton, Milton and others, we can fancy we have seen him ; his loose hood, his dreamy down-cast eyes :

'What man art thou
 That lookest as thou wouldest find a hare,
 For ever on the ground I see thee stare.'

his forked beard, his short, easy-fitting frock or paletot ; his pen-case and pen held daintily over his breast, in the right hand ; a rosary of beads in the {left, falling lower down ; his hosen-clad calves ; his

pointed shoon or rather boots made with a flap like our Canadian galoshes of felt.

The beard excepted, we can visualize to ourselves the young Louis, a as miniature counterpart of his father, with garments of precisely the same cut and pattern ; altogether, perhaps, an old-fashioned looking little figure.

I suggest to a Canadian artist a subject ; ‘Geoffrey Chaucer instructing his son Louis in the use of the Astrolabe.’ There would be a fine opportunity for a mediæval interior, a student’s sanctum of the past, with well-worked-out accessories ; two forms engaged over an astrolabe ; in the wall beyond, an open window shewing a night-sky with a streak of dawn.



